Remarks

The following numbered paragraphs are provided to respond to the similarly numbered paragraphs in the Office Action (e.g., paragraph "1" below corresponds to paragraph 1 in the Office Action).

Response to Office Action Response

1-3. The Office Action indicates that Applicant's arguments regarding Kosugi's failure to teach or suggest a remedy for table sag was moot in light of the fact that the claims do not include this feature. To this end, Applicant has amended claims 1 and 12 to now clearly indicate that the amount of table sag or downward divergence is determined and used for compensating at least one of the data sets prior to combining to form the unified image.

4. Applicant recognizes that the Examiner cited Nutt as teaching a dual imaging system. Applicant's statement regarding Kosugi was provided to show that, because Kosugi does not teach or suggest a configuration including two different types of imaging systems, Kosugi cannot possibly teach a system for combining images from two different systems to create unified images and therefore cannot teach or suggest the last element in each of claims 1 and 12.

5. The Office Action indicates that Applicant's argument regarding Kosugi's failure to teach a compensator for modifying image data for alignment purposes is not persuasive because the claims recite using relative position to modify data sets prior to imaging. Applicant strongly disagrees with this characterization of the claim language.

In this regard, during any (e.g., CT, PET, etc.) imaging session, raw image data sets are first acquired and stored. Thereafter the raw image data sets are manipulated (i.e., filtered, processed, back projected, etc.) to generate final data sets. The final data sets are used to populate a two dimensional image raster thereby forming an image.

According to at least some embodiments of the present invention, PET and CT raw image data sets are acquired and stored. During data acquisition the

amount of table sag is determined. After raw data acquisition, the raw data is modified as a function of the amount of table sag to generate modified image data such that the resulting PET and CT data is anatomically aligned. The aligned data is in turn manipulated (i.e., filtered, back projected, etc.) to generate final data sets used to populate the image raster and to form the final images.

Consistent with the description above, claim 1 requires, among other things, a determiner that uses the amount that a first table segment diverges to determine a relative position during data acquisition and a compensator that uses the relative position to modify the data sets prior to the sets being combined to form a unified image.

Thus, instead of reciting the use of relative position to modify data sets prior to imaging as indicated in the Office Action, claim 1 is limited to a system that performs events in a specific order including (1) relative position determination during data acquisition followed by (2) data modification as a function of the relative position followed by (3) data combining to generate the unified image). Claim 12 includes limitations similar to claim 1 regarding ordered process steps.

Kosugi fails to teach a system wherein data is modified after raw image data is acquired and as a function of relative table-detector position. Instead, as recognized in the most recent Office Action, Kosugi teaches a system wherein position data is used to adjust imaging hardware prior to acquiring an image data set. Applicant has examined Kosugi thoroughly and is clear that no part of Kosugi teaches or suggests that data is modified after data acquisition as a function of the relative position of a detector to a support table. In fact, Kosugi teaches away from a system where image data sets are modified as a function of relative position of a detector to a table by teaching that the relative position of the table and detector are specifically set prior to generating and collecting raw image data (i.e., Kosugi contemplates a system that sets component positions initially and where compensation for sag and hence different relative table-detector position subsequent to data acquisition is not necessary).

6. The Office Action indicates that Applicant's argument regarding Kosugi's failure to teach a system where images are aligned by a compensator is

not persuasive as Applicant's claims do not recite this limitation. Applicant agrees that the claims do not rely on this feature for novelty and believes that the other limitations in the claims distinguish over the cited art.

7. The Office Action indicates that Kosugi teaches a sensor for sensing misalignment of a table to detectors and a determiner for determining the relative position of a table to a detector for altering one set of data as a function of relative position. Applicant strongly disagrees. In this regard, as indicated above, all adjustments to table and detector position in Kosugi occur prior to data acquisition and therefore Kosugi teaches away from adjusting data sets after data acquisition. Moreover, even if Kosugi were read as contemplating some type of data manipulation after raw data acquisition, clearly nothing in Kosugi even remotely suggests data manipulation or modification as a function of relative table-detector position.

8. The Office Action suggests that Nutt's teaching at col. 12, lines 5-15 regarding alignment accuracy in the context of a dual imaging system is sufficient motivation to combine Nutt and Kosugi. Applicant disagrees with this position as the cited section of Nutt clearly teaches that Nutt believed that Nutt's invention "overcame" the table-detector alignment problem. To this end, the cited section of Nutt teaches that "The combined... PET/CT scanner 10 allows registered CT and PET images to be acquired sequentially in a single device, overcoming alignment problems due to internal organ movement, variations in scanner bed profile, and positioning of the patient for the scan." (Emphasis added). Clearly Nutt believed that table 18 (see Fig. 2a) was rigid and that no compensation was required for table divergence or sag – in effect Nutt teaches away from requiring additional compensation for table sag.

9. The sections of the Office Action cited as teaching two sensors for vertical table position do not teach two sensors for this purpose. To this end, col. 3, lines 43-44 teaches that the vertical motion of the bed top 28 is determined and the cited sections of cols. 3 and 4 teach that several sensors are used to sense the

positions of many different components (i.e., of the arm, the table along three axis, etc.). These teachings do not suggest two or more vertical position sensors for table top 28. Instead, when the plural "sensors" is used in column 4, the plural is used to indicate that the system as a whole includes several sensors for different purposes (i.e., one sensor for each of the purposes listed in col. 3). Consistent with this understanding of the cited sections of cols. 3 and 4, Fig. 1 and specification associated therewith teach that table top 28 can move along three different axis but that the top is always completely horizontal. Where a top is always horizontal and is flat all parts of the top are at the same height all the time and it makes no sense to provide more than one sensor for sensing the height or vertical position of the top (i.e., two sensors for vertical height sensing under the circumstances would yield identical values).

Claim Rejections – Section 103

(Portions of the following section have been modified so please consider this section in its entirety)

1-2. The Office Action rejected each of claims 1 and 12 and claims dependent therefrom as obvious over Kosugi in view of Nutt. Applicant has amended each of claims 1 and 12 such that the sensor and sensing step identify an amount that a table section sags and so that the relative table-detector position is determined as a function of the amount of table sag.

The present invention has been developed to compensate for the fact that patient support tables having certain characteristics tend to bend or deflect downward when extended sufficiently to facilitate imaging. To this end, as described in the present specification, when a patient support table is extended for use with a dual imaging CT-PET system, some tables tend to deflect downward at distal ends or along their lengths when extended and the degree of bending often changes as the bed is extended and retracted to different degrees. Where a table bends, raw image data collected by adjacent CT and PET detecting systems is anatomically misaligned and an alignment process is required to generate diagnostically useful unified images.

The present invention solves the data alignment problem in a very simple manner by determining the amount of table bending or deflection and then compensating data sets accordingly so that different first and second data sets can be meaningfully combined. Consistent with this understanding of the present invention, amended claim 1 requires, among other things, first and second imaging configurations that define first and second imaging areas along a translation axis and that generate first and second imaging data sets, a sensor for sensing the amount of downward divergence of at least one table segment as the table is extended from a support and into an imaging area, a determiner using the amount of downward divergence to determine the relative position of at least one of a first imaging detector and a second imaging detector with respect to the table and a compensator that modifies at least one of first and second data sets as a function of the relative position information prior to combining the information sets to form a unified image.

Thus, the function of the present invention is to compensate for table deflection or sagging and the function is accomplished by determining the degree of sagging and compensating at least one of the first and second data sets as a function thereof.

With respect to function, Kosugi fails to even suggest that table deflection may be a concern and therefore cannot possibly teach compensating for table sagging. Instead, Kosugi is provided so that complex imaging sessions can be achieved and repeated several times thereby generating images with system components in identical relative positions. To this end, to properly image certain anatomical structure/functions, Kosugi recognizes that it is necessary to step an imaging system through several different configurations where images are generated with the system in each of the consecutive configurations.

For the purposes of illustration assume that due to the number of moving parts on a system the number of different configurations is essentially unlimited. In addition, assume that for a certain patient a radiologist wishes to generate images with the system in twenty different consecutive configurations. Moreover, assume that over the course of six months the radiologist wishes to repeat the complete imaging process once at the end of each month so that images that correspond to

the same configurations can be compared and a history of images can be generated.

Kosugi provides a system wherein, during the first imaging session when the first set of images are generated, the system is controlled to identify system component/equipment positions and to store the position information in a sequence that includes information, in the present example, for each of the twenty configurations.

At the end of the next month when the radiologist wants to repeat the twenty position image generating series, the radiologist can rely on the system memory and automated control systems to step the session through each of the desired configurations to generate suitable images for comparison.

With respect to form, Kosugi fails to teach or suggest a system wherein a sensor senses the amount of sag of a table section. In addition, Kosugi fails to teach or suggest a compensator for modifying image data after the data is acquired. Moreover, Kosugi fails to teach or suggest modifying acquired image data as a function of relative position of a table to detectors. Thus, Kosugi is clearly different than the claim 1 invention in both form and function.

With respect to Nutt, while Nutt teaches a dual imaging system as recognized by the Examiner, Nutt assumes a completely stiff patient support table. In this regard, Nutt teaches that functional and anatomical images are co-registered without the use of external markers (i.e., akin to determining the position of the table) or internal landmarks (see last sentence in Abstract). With respect to the dual CT-PET system contemplated by Nutt where CT and PET imaging areas are aligned and adjacent each other, as in Kosugi, alignment is supposedly mechanically ensured by moving the table along a single axis through the consecutive imaging areas – here, alignment could only be assumed if the table is completely stiff. This understanding of Nutt is consistent with the first paragraph of Nutt's detailed description that teaches that the dual system overcomes variations in scanner bed profile.

With respect to combining Nutt and Kosugi, the Office Action suggests that Nutt's teaching at col. 12, lines 5-15 regarding alignment accuracy in the context of a dual imaging system is sufficient motivation to combine Nutt and Kosugi. Applicant disagrees as the cited section of Nutt clearly teaches that Nutt believed that Nutt's

invention "overcame" the table-detector alignment problem. To this end, the cited section of Nutt teaches that "The combined... PET/CT scanner 10 allows registered CT and PET images to be acquired sequentially in a single device, overcoming alignment problems due to internal organ movement, variations in scanner bed profile, and positioning of the patient for the scan." (Emphasis added). Clearly Nutt believed that table 18 (see Fig. 2a) was rigid and that no compensation was required for table divergence or sag – Nutt teaches away from additional compensation for table sag.

With respect to claim 12, claim 12 is a method claim that mirrors the limitations of claim 1 and therefore the discussion above is equally applicable to claim 12 and Applicant believes claim 12 is patentable over the cited references.

With respect to each of claims 19 and 21, those claims are similar to claims 1 and 12 except that two sensors are required for sensing the positions of two parts of a support table with respect to the detectors. Thus, the discussion above with respect to claim 1 is applicable to each of claims 19 and 21. In addition, each of claims 19 and 21 require that the two sensors measure vertical positions of two separate table segments. The sections of Kosugi cited in the Office Action teach one sensor for vertical position and a second sensor for longitudinal position, not two sensors for vertical positions.

In this regard Applicant notes that the section of the Office Action addressing Applicant's previous argument (i.e., paragraph 9 of the Office Action) was muddled and could not be understood. If this rejection of Applicants argument is maintained Applicant requests that the Examiner restate the argument in a better form.

In addition, each of claims 19 and 21 requires that the determiner use signals from first and second sensors to determine the relative positions of each of functional and static detectors with respect to a table during data acquisition. Again, Kosugi fails to teach two detectors and therefore cannot teach this limitation. Nutt teaches mechanical alignment of table to detectors (see col. 12, lines 5-15) and hence there would be no need to determine relative positions using sensors, much less signals from two separate sensor. For at least these additional reasons Applicant believes claims 19 and 21 are is patentable over the cited references. Similar comments are applicable to each of claims 5, 7, 14 and 16.

All of the other claims depend from one of claims 1, 12 or 19 and therefore are patentably through dependency.

Applicant has added new claim 22 that covers a system similar to the system of claim 1, albeit where the table and support are part of the body section of the claim.

Applicant has introduced no new matter in making the above amendments and antecedent basis exists in the specification and claims as originally filed for each amendment. In view of the above amendments and remarks, Applicant believes claims 1 – 22 of the present application recite patentable subject matter and allowance of the same is requested. No fee in addition to the fees already authorized in this and accompanying documentation is believed to be required to enter this amendment, however, if an additional fee is required, please charge Deposit Account No. 07-0845 in the amount of the fee.

Respectfully submitted,

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